

Prevalence of Laryngeal Disease in South Korea: Data from the Korea National Health and Nutrition Examination Survey from 2008 to 2011

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interest.

Purpose: The aim of this study was to evaluate the prevalence of Benign Vocal Fold Lesion (polyp, cysts, nodules) and Leukoplakia in Korea. **Materials and Methods:** The data from the 2008 to 2011 Korea National Health and Nutrition Examination Surveys, which were cross-sectional survey of the civilian noninstitutionalized population of South Korea. A survey team that included an otolaryngology residents, nurses, and interviewers moved with a mobile examination unit and performed laryngologic interviews and examinations of vocal folds using rigid telescopic laryngoscopy on survey participants over 19 years old (n=19636). **Results:** Laryngoscopic examination revealed normal results in 19251 (98.04%) of those included in the survey. Abnormal laryngoscopic findings were observed in 1.96% of the population examined, and vocal cord nodules were the most common abnormal finding. The prevalence of vocal cord nodules was 0.99-1.72%, the prevalence of vocal cord polyps was 0.31-0.55%, the prevalence of vocal cysts was 0.04-0.17%, and the prevalence of vocal cord leukoplakia was 0.07-0.21%. There was no significant correlation of linear trend of prevalence by year, and there were no significant differences in prevalence between males and females. **Conclusion:** This is the first nationwide epidemiologic study to assess the prevalence of Benign Vocal Fold Lesion (polyp, cysts, nodules) and Leukoplakia by both the Korean Otolaryngologic Society and the Ministry of Health and Welfare. The results of this large epidemiologic study provide valuable information regarding the prevalence of voice disorders and the management of laryngologic diseases.

Key Words: Prevalence, epidemiology, laryngeal diseases, voice disorders, risks

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INTRODUCTION

Nationwide epidemiological studies conducted by government organizations are powerful tools for investigating the national prevalence of disease conditions. A South Korea government-centered nutrition survey has been conducted annually

since 1969.¹ In 1998, a more systematic health survey was begun as the Korea National Health and Nutrition Examination Survey (KNHANES) by The Ministry of Health and Welfare.¹ This survey conducted a series of three KNHANES in 1998, 2001, and 2005 to examine the general health and nutrition status of Koreans. As of the fourth KNHANES (2007-2009), a total of 4600 households were selected annually. The participants were interviewed about their nutrition, health, and underwent a basic health examination that included a pulmonary function test, blood and urine collection, dental examination, and a blood pressure measurement. Since the Korean Otolaryngologic Society participated in 2008, laryngologic interviews and vocal fold examinations using rigid telescopic laryngoscopy were conducted on the same participants.¹

Nationwide epidemiologic laryngologic surveys are rare.² These surveys, however, can provide accurate information on the prevalence and current status of laryngological diseases, and they also provide planning of health care services designed to treat voice disorders can be undertaken, and they also provide supporting data regarding the welfare of the populace.

The aim of this study were to report the prevalence of laryngeal diseases in South Korea, based on national survey data obtained from the KNHANES of 2008-2011, and to analyze the prevalence of the diseases according to age and gender in order to identify existing trends.

MATERIALS AND METHODS

Study population and data collection

KNHANES is an ongoing cross-sectional survey of the civilian noninstitutionalized population of South Korea over a time span of 3 years. Each year, 10000 to 12000 individuals in 4600 households are selected from a panel to represent the Korean population by using the multistage cluster and stratified random sampling method that is based on the National Census Data. The selected households are asked to participate in the survey, and the participation rate in the past several cycles has ranged from 79% to 84%. The first to third cycles (1998, 2001, and 2004) of the KNHANES and the three years of the fourth cycle collected basic health and nutrition data by conducting interviews and health examinations. From 2008 to 2010, laryngologic interviews and vocal fold examinations using rigid telescopic laryngoscopy have also been conducted. The characteristics of the dis-

eases being studied were considered to determine the age groups targeted on the physical examinations.

We obtained data from the 2008 to 2011 KNHANES. A survey team that included an otolaryngology residents, nurses, and interviewers moved with a mobile examination unit and performed laryngologic interviews and examinations of vocal folds using rigid telescopic laryngoscopy on survey participants over 19 years old (n=19636). Of the participants, 8461 were men and 11175 were women, with a male to female ratio of 1:1.32. Participants ranged in age from 19 to 80 years. All participants provided written informed consent.

A total of 324 surveys were conducted by four survey teams within a time span of 27 weeks in each year. Each survey team had one otolaryngologist, three nurses, and four interviewers. The survey teams moved to pre-assigned locations and performed surveys between Tuesday and Friday. A total of 135 otolaryngology residents from 43 training hospitals were recruited for this project.

The Epidemiologic Survey Committee of the Korean Otolaryngologic Society verified the quality control of the survey, which was conducted by periodically visiting the mobile examination units, periodic education of the participating residents, obtaining of the laryngeal examinations, and data proofing using video documentation of the larynx throughout the study. After that, the two otolaryngologic surgeons from the Korean Otolaryngologic Society verified the video documentation and assessed disease decision protocol. The documentation of video was obtained as 640×480-sized Audio Video Interleave files, which were compressed by DivX 4.12 codec using a compression rate of 6 Mb/sec.

Laryngologic survey

Participants who were 19 years of age or older were examined. A laryngeal examination was performed using a 4 mm 70°-angled rigid endoscope with a CCD camera. Laryngoscopic findings of organic changes such as polyps, nodules, cysts, and leukoplakia were recorded. The Epidemiologic Survey Committee of the Korean Otolaryngologic Society made a disease decision protocol. Symmetric, bilateral, small, and sessile lesions in the mid-membranous vocal fold were diagnosed as vocal nodules, while relatively asymmetric, unilateral, large, or pedunculated lesions in the mid-membranous vocal fold were diagnosed as vocal polyps. Collections of fluid in sac-like formations on the vocal folds were diagnosed as vocal cysts, and white patches of abnormal

tissue seen on the vocal folds were diagnosed as leukoplakia. Uncertain findings to suggest either muscle tension dysphonia or laryngopharyngeal reflux were regarded as normal.

Statistical methods

Weight

Because the Korea National Health and Nutrition Examination Survey is a sampling survey, the authors weighted the examined households in analyzing the data. The weighting was classified into household weighting, which can represent all Korean households, and individual weighting, which can represent the entire Korean population; the latter was used in this study. In addition, the weighting was applied differently for the survey and for the medical examination, and the authors analyzed the data by applying the weighting for the otorhinolaryngologic examination. More detailed methods of applying weighting are described in the report titled "Weighting Calculation of the Fourth Korean National Health and Nutrition Examination Survey (2007-2009) and Sampling Design of the Fifth (2010-2012)."

Statistical methodology

The number of subjects who were positive for abnormal findings on laryngoscopy was analyzed without weighting, with the subjects divided by gender (males and females) and age groups (19 to 29, 30 to 39, 40 to 49, 50 to 59, 60 to 69, and 70 and over) for analysis. Prevalence analysis was weighted to be analyzed as the prevalence rate in the entire population, and the standard error for the prevalence was calculated. The prevalence for the total sample, for each gender, and for each of the age groups was calculated for each year.

Linear contrast of analysis of variance was used in testing in order to observe trends of prevalence changes for the four years. The ratio per year was calculated when the positive served as 1 and the negative served as 0 in the test, and the linear trend of the ratio was tested. Linear contrast analysis was also conducted in order to identify the linear trend of the

prevalence rate based on increase in age group per year. SAS 9.1 (SAS Institute Inc., Cary, NC, USA) was used as the statistical program for the analysis, and the statistical significance level was <0.05 (two-tailed test).

RESULTS

The number of subjects who underwent laryngoscopic examination was 3141 in 2008, 6592 in 2009, 5224 in 2010, and 4679 in 2011. The number of subjects who were positive for abnormal findings was 33 in 2008, 92 in 2009, 80 in 2010, and 53 in 2011. The examinations revealed that 19251 (98.04%) were normal out of a total of 19636 participants. The prevalence of laryngeal disease was 1.96% (Table 1).

Vocal nodules

The prevalence of vocal nodules in the entire Korean population when weighted was 0.99% in 2008, 1.72% in 2009, 1.71% in 2010, and 1.21% in 2011. The linear trend of prevalence per year was statistically insignificant ($p=0.531$) (Table 2, Fig. 1).

The prevalence per age group was highest in the 30-39 age group in 2008 (1.51%), in the 19-29 age group in 2009 (3.07%), in the 30-39 age group in 2010 (2.55%), and in the 50-59 age group in 2011 (1.66%) (Table 2). In all of the age groups, the linear trend showing increase or decrease in prevalence per year was statistically insignificant (all $p>0.05$).

When the trend of increase or decrease in prevalence per year was tested based age, the prevalence in both 2009 and 2010 decreased as the age group increased (each $p=0.002$). The prevalence in 2008 and 2011 decreased as the age group increased, but without statistical significance ($p=0.052$, $p=0.073$, respectively) (Table 2).

The prevalence based on gender was 0.70% in 2008, 1.79% in 2009, 1.64% in 2010, and 1.01% in 2011 in males without a statistical linear trend ($p=0.580$). Meanwhile, the prevalence in females was 1.26% in 2008, 1.66% in 2009,

Table 1. The Prevalence of Laryngeal Disease

	Total					Male					Female				
	2008	2009	2010	2011	Sum	2008	2009	2010	2011	Sum	2008	2009	2010	2011	Sum
Sample size	3141	6592	5224	4679	19636	1313	2846	2257	2045	8461	1828	3746	2967	2634	11175
Vocal nodule (+)	33	92	80	53	258	11	42	30	18	101	22	50	50	35	157
Vocal polyp (+)	16	20	23	24	83	11	11	13	11	46	5	9	10	13	37
Vocal cyst (+)	3	10	3	5	21	1	6	3	1	11	2	4	0	4	10
Leukoplakia (+)	9	6	5	3	23	8	5	5	2	20	1	1	0	1	3

1.77% in 2010, and 1.41% in 2011, also without a statistical linear trend ($p=0.681$) (Table 2 and 3).

The linear trend of the prevalence based on years and age was statistically insignificant in both males and females (all

$p>0.05$). The prevalence per year decreased as the age group increased in 2009 for males ($p=0.025$) and in 2008 ($p=0.006$), 2009 ($p=0.002$), and 2010 ($p<0.001$) for females (Table 2 and 3).

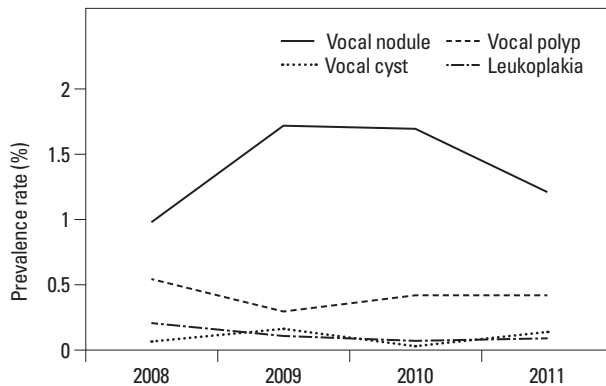


Fig. 1. The prevalence of laryngeal disease.

Vocal polyps

The prevalence of vocal polyps in the entire Korean population when weighted was 0.55% in 2008, 0.31% in 2009, 0.43% in 2010, and 0.43% in 2011. The linear trend of prevalence per year was statistically insignificant ($p=0.686$) (Table 3, Fig. 1).

The prevalence per age group was highest in the 30-39 age group in 2008 (0.82%), in the 50-59 age group in 2009 (0.71%), in the 50-59 age group in 2010 (0.86%), and in the 50-59 age group in 2011 (1.18%) (Table 3). In all of the age groups, the linear trend showing increase or decrease in prev-

Table 2. The Prevalence of Vocal Nodules

	Total												<i>p</i> value*
	2008			2009			2010			2011			
	No.	Prev.	SE	No.	Prev.	SE	No.	Prev.	SE	No.	Prev.	SE	
Vocal nodule-total													
Total	3141	0.99	(0.23)	6592	1.72	(0.34)	5224	1.71	(0.27)	4679	1.21	(0.22)	0.531
19-29	457	0.94	(0.39)	952	3.07	(0.88)	661	2.51	(0.72)	550	1.50	(0.66)	0.663
30-39	641	1.51	(0.57)	1285	2.10	(0.44)	1063	2.55	(0.58)	892	1.33	(0.38)	0.977
40-49	613	0.87	(0.38)	1289	1.10	(0.35)	982	1.50	(0.48)	803	1.11	(0.48)	0.555
50-59	522	0.89	(0.46)	1075	1.22	(0.37)	964	0.93	(0.31)	875	1.66	(0.48)	0.330
60-69	503	1.11	(0.47)	1074	1.21	(0.58)	845	0.99	(0.56)	798	0.54	(0.24)	0.281
≥70	405	0.00	-	917	0.67	(0.39)	709	0.62	(0.27)	761	0.46	(0.27)	0.152
<i>p</i> value [†]		0.052			0.002			0.002			0.073		
Vocal nodule-male													
Total	1313	0.70	(0.29)	2846	1.79	(0.37)	2257	1.64	(0.45)	2045	1.01	(0.30)	0.580
19-29	185	0.00	-	444	2.81	(1.10)	261	2.31	(1.11)	236	2.03	(1.17)	0.143
30-39	277	1.71	(0.99)	537	1.75	(0.56)	452	1.53	(0.72)	366	0.58	(0.33)	0.270
40-49	265	0.14	(0.14)	552	1.87	(0.63)	446	1.66	(0.73)	356	1.06	(0.67)	0.259
50-59	221	0.60	(0.44)	455	0.91	(0.41)	394	1.19	(0.49)	384	0.72	(0.43)	0.745
60-69	205	1.75	(0.92)	479	1.92	(0.90)	395	1.74	(1.17)	370	0.38	(0.23)	0.179
≥70	160	0.00	-	379	0.22	(0.22)	309	0.88	(0.57)	333	0.82	(0.57)	0.089
<i>p</i> value [†]		0.861			0.025			0.419			0.290		
Vocal nodule-female													
Total	1828	1.26	(0.28)	3746	1.66	(0.40)	2967	1.77	(0.27)	2634	1.41	(0.31)	0.681
19-29	272	1.93	(0.80)	508	3.37	(0.93)	400	2.72	(0.99)	314	0.91	(0.52)	0.243
30-39	364	1.29	(0.53)	748	2.46	(0.67)	611	3.66	(0.86)	526	2.14	(0.68)	0.181
40-49	348	1.63	(0.76)	737	0.32	(0.19)	536	1.33	(0.53)	447	1.16	(0.66)	0.902
50-59	301	1.19	(0.85)	620	1.52	(0.62)	570	0.69	(0.32)	491	2.60	(0.90)	0.365
60-69	298	0.52	(0.40)	595	0.58	(0.37)	450	0.33	(0.24)	428	0.70	(0.42)	0.873
≥70	245	0.00	-	538	0.95	(0.62)	400	0.46	(0.27)	428	0.22	(0.22)	0.864
<i>p</i> value [†]		0.006			0.002			<0.001			0.104		

SE, standard error.

*Test of the linear relationship of year with linear contrast.

†Test of the linear relationship of age with linear contrast.

alence per year was statistically insignificant (all $p>0.05$).

When the trend of increase or decrease in prevalence per year based on the age groups was tested, the prevalence in 2011 decreased as the age group increased (each $p=0.039$). The prevalence in 2008, 2009, and 2011 decreased as the age group increased, but without statistical significance ($p=0.259$, $p=0.460$, $p=0.501$, respectively) (Table 3).

The prevalence based on gender was 0.94% in 2008, 0.42% in 2009, 0.56% in 2010, and 0.48% in 2011 in males without a statistical linear trend ($p=0.255$). Meanwhile, the prevalence in females was 0.16% in 2008, 0.20% in 2009, 0.32% in 2010, and 0.38% in 2011, also without a statistical linear trend ($p=0.103$) (Table 3).

The linear trend of the prevalence based on years per age group was statistically insignificant in both males and females (all $p>0.05$). The prevalence per year decreased as

the age group increased in 2008 for males ($p=0.040$) and in 2011 ($p=0.012$) for females (Table 3).

Vocal cysts

The prevalence of vocal cysts in the entire Korean population when weighted was 0.06% in 2008, 0.17% in 2009, 0.04% in 2010, and 0.14% in 2011. The linear trend of prevalence per year was statistically insignificant ($p=0.746$) (Table 4, Fig. 1).

The prevalence per age group was highest in the 50-59 age group in 2008 (0.29%), in the over 70 age group in 2009 (0.48%), in the over 70 age group in 2010 (0.21%), and in the 40-49 age group in 2011 (0.33%) (Table 4). In all of the age groups, the linear trend showing increase or decrease in prevalence per year was statistically insignificant (all $p>0.05$).

Table 3. The Prevalence of Vocal Polyps

	Total												<i>p</i> value*
	2008			2009			2010			2011			
	No.	Prev.	SE	No.	Prev.	SE	No.	Prev.	SE	No.	Prev.	SE	
Vocal polyp-total													
Total	3141	0.55	(0.15)	6592	0.31	(0.09)	5224	0.43	(0.11)	4679	0.43	(0.12)	0.686
19-29	457	0.48	(0.38)	952	0.14	(0.10)	661	0.30	(0.30)	550	0.32	(0.23)	0.814
30-39	641	0.82	(0.45)	1285	0.39	(0.22)	1063	0.55	(0.26)	892	0.04	(0.04)	0.121
40-49	613	0.62	(0.32)	1289	0.04	(0.04)	982	0.33	(0.17)	803	0.12	(0.12)	0.236
50-59	522	0.42	(0.30)	1075	0.71	(0.40)	964	0.86	(0.33)	875	1.18	(0.50)	0.186
60-69	503	0.48	(0.29)	1074	0.60	(0.23)	845	0.16	(0.12)	798	0.56	(0.26)	0.867
≥70	405	0.13	(0.13)	917	0.07	(0.07)	709	0.18	(0.13)	761	0.72	(0.35)	0.095
<i>p</i> value [†]		0.259			0.460			0.501			0.039		
Vocal polyp-male													
Total	1313	0.94	(0.30)	2846	0.42	(0.16)	2257	0.56	(0.19)	2045	0.48	(0.19)	0.255
19-29	185	0.94	(0.73)	444	0.11	(0.11)	261	0.60	(0.59)	236	0.61	(0.44)	0.851
30-39	277	1.39	(0.84)	537	0.67	(0.42)	452	0.58	(0.42)	366	0.00	-	0.101
40-49	265	1.22	(0.62)	552	0.00	-	446	0.15	(0.15)	356	0.00	-	0.062
50-59	221	0.84	(0.60)	455	0.98	(0.70)	394	1.15	(0.53)	384	1.73	(0.96)	0.417
60-69	205	0.00	-	479	0.74	(0.39)	395	0.34	(0.25)	370	0.32	(0.23)	0.492
≥70	160	0.00	-	379	0.18	(0.18)	309	0.46	(0.33)	333	0.33	(0.32)	0.227
<i>p</i> value [†]		0.040			0.517			0.917			0.672		
Vocal polyp-female													
Total	1828	0.16	(0.08)	3746	0.20	(0.07)	2967	0.32	(0.12)	2634	0.38	(0.13)	0.103
19-29	272	0.00	-	508	0.17	(0.17)	400	0.00	-	314	0.00	-	0.320
30-39	364	0.20	(0.20)	748	0.10	(0.10)	611	0.52	(0.32)	526	0.08	(0.08)	0.925
40-49	348	0.00	-	737	0.09	(0.09)	536	0.51	(0.31)	447	0.25	(0.25)	0.150
50-59	301	0.00	-	620	0.44	(0.28)	570	0.59	(0.34)	491	0.63	(0.37)	0.094
60-69	298	0.93	(0.55)	595	0.48	(0.28)	450	0.00	-	428	0.79	(0.47)	0.684
≥70	245	0.21	(0.21)	538	0.00	-	400	0.00	-	428	1.00	(0.54)	0.177
<i>p</i> value [†]		0.118			0.596			0.149			0.012		

SE, standard error.

*Test of the linear relationship of year with linear contrast.

†Test of the linear relationship of age with linear contrast.

When the trend of increase or decrease in prevalence per year based on the age groups was tested, the prevalence was not statistically significant in any of the years ($p=0.147$, $p=0.110$, $p=0.506$, $p=0.366$, respectively) (Table 4).

The prevalence based on gender was 0.07% in 2008, 0.20% in 2009, 0.07% in 2010, and 0.12% in 2011 in males without a statistical linear trend ($p=0.945$). Meanwhile, the prevalence in females was 0.05% in 2008, 0.15% in 2009, 0.00% in 2010, and 0.16% in 2011, also without a statistical linear trend ($p=0.551$) (Table 3 and 4).

The linear trend of the prevalence based on years per age group was statistically insignificant in both males and females (all $p>0.05$) (Table 3 and 4).

Leukoplakia

The prevalence of leukoplakia in the entire Korean popula-

tion when weighted was 0.21% in 2008, 0.11% in 2009, 0.07% in 2010, and 0.10% in 2011. The linear trend of prevalence per year was statistically insignificant ($p=0.242$) (Table 5, Fig. 1).

The prevalence per age group was highest in the over 70 age group in 2008 (0.55%), in the 60-69 age group in 2009 (0.28%), in the over 70 age group in 2010 (0.56%), and in the 30-39 age group in 2011 (0.31%) (Table 5). In all of the age groups, the linear trend showing increase or decrease in prevalence per year was statistically insignificant (all $p>0.05$).

When the trend of increase or decrease in prevalence per year based on the age groups was tested, the prevalence of all the age groups increased, but without statistical significance ($p=0.117$, $p=0.921$, $p=0.058$, $p=0.725$, respectively) (Table 5).

Table 4. The Prevalence of Vocal Cysts

	Total												<i>p</i> value*
	2008			2009			2010			2011			
	No.	Prev.	SE	No.	Prev.	SE	No.	Prev.	SE	No.	Prev.	SE	
Vocal cyst-total													
Total	3141	0.06	(0.04)	6592	0.17	(0.07)	5224	0.04	(0.02)	4679	0.14	(0.09)	0.746
19-29	457	0.00	-	952	0.00	-	661	0.09	(0.09)	550	0.00	-	0.320
30-39	641	0.00	-	1285	0.17	(0.17)	1063	0.00	-	892	0.09	(0.09)	0.741
40-49	613	0.00	-	1289	0.17	(0.13)	982	0.00	-	803	0.33	(0.29)	0.342
50-59	522	0.29	(0.24)	1075	0.32	(0.23)	964	0.00	-	875	0.30	(0.21)	0.763
60-69	503	0.16	(0.16)	1074	0.06	(0.06)	845	0.00	-	798	0.00	-	0.264
≥70	405	0.00	-	917	0.48	(0.27)	709	0.21	(0.15)	761	0.00	-	0.373
<i>p</i> value [†]		0.147			0.110			0.506			0.366		
Vocal cyst-male													
Total	1313	0.07	(0.07)	2846	0.20	(0.10)	2257	0.07	(0.05)	2045	0.12	(0.12)	0.945
19-29	185	0.00	-	444	0.00	-	261	0.18	(0.18)	236	0.00	-	0.319
30-39	277	0.00	-	537	0.33	(0.33)	452	0.00	-	366	0.00	-	0.312
40-49	265	0.00	-	552	0.00	-	446	0.00	-	356	0.55	(0.54)	0.307
50-59	221	0.45	(0.45)	455	0.24	(0.24)	394	0.00	-	384	0.00	-	0.249
60-69	205	0.00	-	479	0.00	-	395	0.00	-	370	0.00	-	-
≥70	160	0.00	-	379	1.26	(0.70)	309	0.54	(0.38)	333	0.00	-	0.368
<i>p</i> value [†]		0.320			0.127			0.398			0.307		
Vocal cyst-female													
Total	1828	0.05	(0.04)	3746	0.15	(0.09)	2967	0.00	-	2634	0.16	(0.09)	0.551
19-29	272	0.00	-	508	0.00	-	400	0.00	-	314	0.00	-	-
30-39	364	0.00	-	748	0.00	-	611	0.00	-	526	0.19	(0.19)	0.319
40-49	348	0.00	-	737	0.34	(0.27)	536	0.00	-	447	0.09	(0.09)	0.880
50-59	301	0.14	(0.14)	620	0.40	(0.40)	570	0.00	-	491	0.60	(0.42)	0.468
60-69	298	0.32	(0.32)	595	0.12	(0.12)	450	0.00	-	428	0.00	-	0.266
≥70	245	0.00	-	538	0.00	-	400	0.00	-	428	0.00	-	-
<i>p</i> value [†]		0.258			0.486			-			0.937		

SE, standard error.

*Test of the linear relationship of year with linear contrast.

†Test of the linear relationship of age with linear contrast.

The prevalence based on gender was 0.38% in 2008, 0.16% in 2009, 0.15% in 2010, and 0.16% in 2011 in males without a statistical linear trend ($p=0.294$). Meanwhile, the prevalence in females was 0.04% in 2008, 0.07% in 2009, 0.00% in 2010, and 0.03% in 2011, also without a statistical linear trend ($p=0.538$) (Table 3 and 5).

The linear trend of the prevalence based on years per age group was statistically insignificant in both males and females (all $p>0.05$) (Table 3 and 5).

DISCUSSION

To the best of our knowledge, this is the first epidemiologic study that has investigated the prevalence of laryngologic diseases, based on nationally representative data from a

government-centered survey. In the absence of reliable epidemiologic data, it is difficult to precisely identify specific populations at risk, to delineate the causes and effects of laryngeal disease, to develop early screening procedures to detect those at risk, to estimate social costs related to laryngeal disease, and the planning of health care services designed to prevent or treat voice disorders.³

Epidemiologic survey of the prevalence and risk factors of laryngeal disease in the general population are rare. Moreover, only a few studies that exist are characterized by substantial variability in reported prevalence estimates, ranging from 0.65% to 15% in the general population.³⁻⁶ The discrepancies among the studies are related to inconsistent definitions of what constitutes a laryngeal disease, methodological differences involving sampling procedures, and variations in sample sizes and populations, among other issues. Thus,

Table 5. The Prevalence of Leukoplakia

	Total												<i>p</i> value*
	2008			2009			2010			2011			
	No.	Prev.	SE	No.	Prev.	SE	No.	Prev.	SE	No.	Prev.	SE	
Leukoplakia-total													
Total	3141	0.21	(0.08)	6592	0.11	(0.05)	5224	0.07	(0.04)	4679	0.10	(0.07)	0.242
19-29	457	0.00	-	952	0.18	(0.17)	661	0.00	-	550	0.00	-	0.315
30-39	641	0.19	(0.19)	1285	0.12	(0.12)	1063	0.00	-	892	0.31	(0.31)	0.843
40-49	613	0.12	(0.12)	1289	0.07	(0.07)	982	0.00	-	803	0.00	-	0.241
50-59	522	0.53	(0.33)	1075	0.00	-	964	0.00	-	875	0.09	(0.09)	0.194
60-69	503	0.10	(0.10)	1074	0.28	(0.21)	845	0.25	(0.21)	798	0.15	(0.15)	0.831
≥70	405	0.55	(0.34)	917	0.07	(0.07)	709	0.56	(0.35)	761	0.00	-	0.279
<i>p</i> value [†]	0.117			0.921			0.058			0.725			
Leukoplakia-male													
Total	1313	0.38	(0.15)	2846	0.16	(0.08)	2257	0.15	(0.08)	2045	0.16	(0.13)	0.294
19-29	185	0.00	-	444	0.00	-	261	0.00	-	236	0.00	-	-
30-39	277	0.37	(0.37)	537	0.24	(0.24)	452	0.00	-	366	0.59	(0.59)	0.841
40-49	265	0.23	(0.23)	552	0.14	(0.14)	446	0.00	-	356	0.00	-	0.241
50-59	221	1.06	(0.65)	455	0.00	-	394	0.00	-	384	0.00	-	0.106
60-69	205	0.21	(0.21)	479	0.60	(0.44)	395	0.53	(0.44)	370	0.31	(0.31)	0.843
≥70	160	0.77	(0.57)	379	0.18	(0.18)	309	1.48	(0.91)	333	0.00	-	0.605
<i>p</i> value [†]	0.193			0.293			0.064			0.680			
Leukoplakia-female													
Total	1828	0.04	(0.04)	3746	0.07	(0.07)	2967	0.00	-	2634	0.03	(0.03)	0.538
19-29	272	0.00	-	508	0.37	(0.37)	400	0.00	-	314	0.00	-	0.314
30-39	364	0.00	-	748	0.00	-	611	0.00	-	526	0.00	-	-
40-49	348	0.00	-	737	0.00	-	536	0.00	-	447	0.00	-	-
50-59	301	0.00	-	620	0.00	-	570	0.00	-	491	0.18	(0.18)	0.315
60-69	298	0.00	-	595	0.00	-	450	0.00	-	428	0.00	-	-
≥70	245	0.43	(0.43)	538	0.00	-	400	0.00	-	428	0.00	-	0.314
<i>p</i> value [†]	0.314			0.314			-			0.315			

SE, standard error.

*Test of the linear relationship of year with linear contrast.

†Test of the linear relationship of age with linear contrast.

the true prevalence of laryngeal disease in the general population remains undetermined.³

In most studies, enrolled subjects were limited to a population of a specific age, such as pediatric⁷⁻¹⁰ or geriatric populations,¹¹ or a population specific to a particular occupation, such as telemarketers,¹² teachers,^{13,14} or future speech language pathologists.¹⁵ To our knowledge, this survey is the largest epidemiologic study on the prevalence of laryngeal disease in a general population. Although there are some other reports that have also investigated the prevalence of laryngeal diseases,^{3,4} none of these studies utilized laryngoscopy as a primary evaluation tool and employed trained otolaryngologists.

The diagnosis of vocal polyps or nodules is common among voice disorder patients visiting outpatient clinics. Some reports exist on the prevalence of vocal nodules in teachers.^{14,16,17} However, the prevalence of vocal polyps, nodules, cysts, and leukoplakia in the general population has not been previously reported. In the present study, 0.99-1.72% and 0.31-0.55% of the population had vocal nodules and polyps, respectively, 0.04-0.17% had vocal cysts, and 0.07-0.21% had leukoplakia.

Although many of these laryngeal diseases are presumably related to infectious processes, others appear to be chronic and linked to specific occupational or social voice use pattern, medical condition, and other factor, which increase vulnerability to a laryngeal disease.³

For instance, it was assumed that women would have a higher prevalence of voice disorders than man. It has been accepted that women are more vulnerable to voice disorders because of structural and functional differences (shorter vocal folds and produce voice at a higher fundamental frequency) and therefore there is less tissue mass to dampen a larger amount of vibratory force. In this report, however, the gender difference in the prevalence of laryngeal disease was not significant.

In another example, elderly people have lower amounts of hyaluronic acid (HA) in the vocal folds. HA is most concentrated in vocal fold body areas of high shock absorption, and it plays an important role in wound repair.^{18,19} Less HA in the vocal folds of those who are aging may suggest that there is less protective tissue dampening and potentially a reduced wound healing response.³ In this report, however, we found that the prevalence of laryngeal disease did not differ with age.

This survey provided information on the prevalence and current status of laryngological diseases. This survey should

be used to develop prevention and education programs targeting specific groups that are at highest risk of gender, family history, age, voice use patterns. Furthermore, they also provide supporting data regarding the welfare of the populace and the planning of health care services designed to treat voice disorders can be undertaken.

In this study, the big problem was that the participants experienced the discomfort about laryngoscopy. However, in an effort to acquire many participants as possible, nearly almost video documentation were acquired. Finally, the participants who could not tolerate laryngoscopy were excluded. The overall rate of video documentation acquired was 99.11% However, participants consistently refused laryngoscopy in 2012 KNHANES.

In conclusion, this is the first epidemiologic study conducted by both the Otolaryngologic Society and the Ministry of Health and Welfare of Korea, and offer insights into the prevalence of laryngeal diseases and into groups that are potentially vulnerable to these diseases in Korea. Nevertheless, further in-depth studies are needed based on this ongoing survey, to better understand the etiologic factors that may be associated with laryngeal diseases and to evaluate specific interventions aimed at the prevention of disease-related disabilities.

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REFERENCES

1. Cho YS, Choi SH, Park KH, Park HJ, Kim JW, Moon IJ, et al. Prevalence of otolaryngologic diseases in South Korea: data from the Korea national health and nutrition examination survey 2008. *Clin Exp Otorhinolaryngol* 2010;3:183-93.
2. Agrawal Y, Platz EA, Niparko JK. Prevalence of hearing loss and differences by demographic characteristics among US adults: data

- from the National Health and Nutrition Examination Survey, 1999-2004. *Arch Intern Med* 2008;168:1522-30.
3. Roy N, Merrill RM, Gray SD, Smith EM. Voice disorders in the general population: prevalence, risk factors, and occupational impact. *Laryngoscope* 2005;115:1988-95.
 4. Laguaite JK. Adult voice screening. *J Speech Hear Disord* 1972; 37:147-51.
 5. Morley DE. A ten-year survey of speech disorders among university students. *J Speech Disord* 1952;17:25-31.
 6. Smith E, Lemke J, Taylor M, Kirchner HL, Hoffman H. Frequency of voice problems among teachers and other occupations. *J Voice* 1998;12:480-8.
 7. Akif Kiliç M, Okur E, Yildirim I, Güzelsoy S. The prevalence of vocal fold nodules in school age children. *Int J Pediatr Otorhinolaryngol* 2004;68:409-12.
 8. Angelillo N, Di Costanzo B, Angelillo M, Costa G, Barillari MR, Barillari U. Epidemiological study on vocal disorders in paediatric age. *J Prev Med Hyg* 2008;49:1-5.
 9. Duff MC, Proctor A, Yairi E. Prevalence of voice disorders in African American and European American preschoolers. *J Voice* 2004;18:348-53.
 10. Powell M, Filter MD, Williams B. A longitudinal study of the prevalence of voice disorders in children from a rural school division. *J Commun Disord* 1989;22:375-82.
 11. Roy N, Stemple J, Merrill RM, Thomas L. Epidemiology of voice disorders in the elderly: preliminary findings. *Laryngoscope* 2007; 117:628-33.
 12. Jones K, Sigmon J, Hock L, Nelson E, Sullivan M, Ogren F. Prevalence and risk factors for voice problems among telemarketers. *Arch Otolaryngol Head Neck Surg* 2002;128:571-7.
 13. Roy N, Merrill RM, Thibeault S, Parsa RA, Gray SD, Smith EM. Prevalence of voice disorders in teachers and the general population. *J Speech Lang Hear Res* 2004;47:281-93.
 14. Sliwinska-Kowalska M, Niebudek-Bogusz E, Fiszer M, Los-Spychalska T, Kotylo P, Sznurowska-Przygocka B, et al. The prevalence and risk factors for occupational voice disorders in teachers. *Folia Phoniatr Logop* 2006;58:85-101.
 15. Gottliebson RO, Lee L, Weinrich B, Sanders J. Voice problems of future speech-language pathologists. *J Voice* 2007;21:699-704.
 16. Van Houtte E, Van Lierde K, D'Haeseleer E, Claeys S. The prevalence of laryngeal pathology in a treatment-seeking population with dysphonia. *Laryngoscope* 2010;120:306-12.
 17. Smith E, Kirchner HL, Taylor M, Hoffman H, Lemke JH. Voice problems among teachers: differences by gender and teaching characteristics. *J Voice* 1998;12:328-34.
 18. Ward PD, Thibeault SL, Gray SD. Hyaluronic acid: its role in voice. *J Voice* 2002;16:303-9.
 19. Woo SH, Jeong HS, Kim JP, Koh EH, Lee SU, Jin SM, et al. Favorable vocal fold wound healing induced by platelet-rich plasma injection. *Clin Exp Otorhinolaryngol* 2014;7:47-52.